

10.

A Revision of the Kingfishers, *Ceyx erithacus* and *rufidorsus*.

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These two species of kingfisher are important members of the Indo-Malayan avifauna. For many years their identification has proved a stumbling block and a very large amount of literature has collected around them. The most recent discussion of the problem, that of Chasen & Kloss (1929), has served to clear up many difficulties. I believe, however, that one or two interesting facts remain to be pointed out, and it is in an effort to do so that I have turned to these species in this paper.

Kingfishers in general tend to show a constancy of plumage pattern which is striking. Certain characteristic colors reappear again and again. Some colors, as brown and yellow, seem to be closely linked and substitute for each other with great regularity. Plumage patterns are nearly uniform throughout the family. In the case of these two species of *Ceyx*, the color and size resemblances are so particularly close that the conclusion that these birds are very nearly related seems inescapable.

The next nearest relation of these two species is *Ceyx melanurus* with three races from the Philippines.

I am much indebted to Mr. J. L. Peters for reading over this manuscript as well as to the authorities of the United States National Museum, the Academy of Natural Sciences of Philadelphia and the American Museum of Natural History for the loan of specimens. In the following discussion all measurements are in millimetres, the wing pressed flat against the ruler, and the bill measured from the distal end of the external naris to the terminal point of the maxilla.

For easy identification of these two species, it might be well to insert here a key by which identification can be made.

- A. Upper parts rufous with a lilac wash.
 - a. Forehead with a dark blue-black spot . . . *C. erithacus*.
 - b. Forehead spot absent . . . *C. rufidorsus*.
 - a'. A patch of ultramarine in the supraocular region . . . *C. erithacus*.
 - b'. Supraocular patch lacking . . . *C. rufidorsus*.

- a". Scapulars black with an ultramarine wash . . . *C. erithacus*.
- b". Scapulars rufous with a lilac wash . . . *C. rufidorsus*.
- a' ". Wing coverts black tipped with ultramarine . . . *C. erithacus*.
- b' ". Wing coverts rufous tipped with lilac . . . *C. rufidorsus*.

Ceyx erithacus erithacus (Linnaeus).

Alcedo erithaca Linnaeus, Sys. Nat. 10, T. p. 115, 1758.

Description: For the adult bird see Sharpe (1892, p. 175). The rufous on the bend of the wing often extends to the lesser wing coverts.

Juvenal birds are distinguished from adults by several characteristic features. The bill is rather short and pale, often dusky at the base. On the upper surface the plumage is the same as the adult, but the scapulars tend to be tipped rather than washed with ultramarine. Instead of being washed with lilac, the feathers of the lower back sometimes are tinted with cobalt. The tail is often, but not invariably, tipped with black. Below, juvenal and immature birds show a very characteristic plumage. The throat is pure white not tinted with yellow. The lower cheeks, flanks, thighs, under tail coverts, and a band across the breast and upper abdomen are rufous, sometimes with an orange tint.

Measurements: Wing, ♂ 53–58.5 (55.8), ♀ 55–60 (56.8). Tail, ♂ 20–23.5 (22.6), ♀ 2.15–24.5 (23.1). Wing-tail index 38–42%. Bill, from naris, ♂ and ♀, 25–28.2 (27.2).

Range: Ceylon through the lowland coastal parts of India to Nepal, Assam, Burma, *vide* Stuart Baker (1927), the Malay Peninsula, Siam, Indo-China, southern China, Hainan, Andaman Ids, small islands in the Straits of Malacca and off the Malay Peninsula, coast of Sumatra.

Specimens Examined: Sixteen.

Discussion: This form is well established in continental Asia but only sparingly distributed among the islands. Such a distribution indicates a later origin than that of *rufidorsus* which has extended into the

Greater and Lesser Sunda area. The latter having become established in the Greater Sundas and adjacent islands, there has been a secondary infiltration perhaps in two waves by *erithacus*, which has succeeded in colonizing a few of the small islands not already reached by *rufidorsus* (Nicobars, Nias) and in competing with the latter species in the larger continental areas (Malay Peninsula, Borneo).

From the evidence afforded by specimens, Sumatra seems to be primarily the home of *rufidorsus*. I have examined the type of *Ceyx enopopygius* (Oberholser, 1912) and concur with Chasen & Kloss (1929) in their belief that it is an unusually bright immature specimen. The measurements of this specimen (wing 57.5, tail 23.5, bill 27.7) are not different from normal *erithacus*. The only other examples of *erithacus* from Sumatra are two males listed in Laubmann (1925). These three records are from coastal localities and this coupled with Robinson & Kloss' (1922) record of this species as being a bird commonly killed at one of the lighthouses in Malacca Strait leads me to suspect that the Sumatra records are accidental. These birds in contrast to *Ceyx rufidorsus* (Robinson, 1917) are subject to erratic local movements which result in isolated records appearing all over the islands of Malacca Strait and the adjacent Sumatran coast. This is a subject which should be studied more carefully. It is possible that some physiological dispersal mechanism is at work here which may be akin to migration.

Ceyx erithacus macrocarus Oberholser.

Ceyx erithacus macrocarus Oberholser, *Bull.* 98, *U. S. Nat. Mus.*, 23, 1917.

Description: Differs from *erithacus* by being larger. The forehead spot is smaller in two examples.

A nestling, A.M.N.H. 637008, is colored as the adult except for the reduction of the ultramarine wash on the scapulars back and median wing coverts to a series of spots. The shaft and the terminal part of the tail are black. Below the bird is similar to young of *erithacus*. This specimen was collected Oct. 4, 1905.

Measurements: Wing, ♂ 58–60.3 (59.4), ♀ 61. Tail, ♂ 23.–24 (23.4), ♀ 24.5. Wing-tail index 39–40. Bill, ♂ and ♀ 30–31 (30.4).

Range: Great Nicobar, Nicobar Ids.

Specimens Examined: Five.

Discussion: The most significant character of this race is its larger size, especially in bill measurements. It is interesting that the Andamans seem to be populated by typical *erithacus*. This is in contrast to the usual case in which Andaman and Nicobar populations tend to be identical. A single male from South Andaman (A.M.N.H.

637011) is characteristically of the smaller subspecies. This particular specimen is notable for a very heavy blue forehead spot which extends back broadly onto the crown.

In order to check on the above measurements, I have estimated the probability of these two populations being identical by use of the formula of *T* for deviations from the mean in small samples as discussed by Simpson & Roe (1939). This formula allows a very critical estimation when, as in this case, the combined samples of adult specimens are less than fifteen. By using the formula on the wing, tail, and bill measurements, *T* proves to be very significant for the bill (6.0), significant for the wing (3.1) and insignificant for the tail (1.5). Thus even on the basis of the bill alone, *macrocarus* is a justifiable race.

Ceyx erithacus motleyi Chasen & Kloss.

Ceyx erithacus motleyi, Chasen & Kloss, *Festsch. für E. Hartert, Journ. f. Ornith.*, p. 106, 1929.

Description: This and the following two races differ from *erithacus* and *macrocarus* by having the rufous tinted with lilac of the pileum and nape extending down on the back and continuous with the lower back and rump. The rest of the plumage, however, is similar to the typical subspecies.

The immature plumage differs from the adult as in *erithacus*.

Measurements: Wing, ♂ 57.5–60.5 (59.5). Tail, ♂ 22–24 (22.8). Wing-tail index 36–39. Bill, ♂ 28.5–30 (29.1).

Range: Borneo, Banguey Is, Labuan (?).

Specimens Examined: Five.

Discussion: The confusion resulting over the description of *Ceyx dillwynni* and *sharpei* from Borneo was finally resolved by Chasen & Kloss (1929). I believe, however, that they were mistaken in assuming Sharpe's plate of *dillwynni* (1868-71) to be a representation of an immature specimen of *rufidorsus*. I have before me two male adult specimens (M.C.Z. 197135, 197136) which correspond very closely to Sharpe's plate. I believe that they are hybrids between *rufidorsus* and *motleyi*. From a careful examination of the specimens it is difficult to escape the conclusion that where *erithacus* overlaps into the range of *rufidorsus*, hybridization has occurred. Indeed Sharpe had apparently already begun to suspect this by the time that he was working on the Catalogue of the Birds in the British Museum. In that volume (1892) he transfers his original description of *dillwynni* to a description of what is now *motleyi* and lists several dubious specimens which he remarks may be "in changing plumage . . . or are hybrids." A description of some of these specimens may be appropriate at this point.

(1). M.C.Z. 197135, ♂, ad. Kalabakang R., Borneo, coll. July 7, 1937. H. G. Deignan. Above this specimen is similar to typical *motleyi*, but the forehead spot is very much reduced as is also the supraocular patch of ultramarine. The scapulars are washed with ultramarine, but tipped with pale lilac. The lesser and median wing coverts are strongly rufous (more so than in Sharpe's plate). The distal outer margins of the secondaries as well as the inner margins are edged with rufous. Below the bird is similar to the adult of either *rufidorsus* or *erithacus*.

(2). M.C.Z. 197136, ♂, ad. Kalabakang R., Borneo, July 14, 1937. H. G. Deignan. Above this specimen lacks any hint of forehead spot and again the supraocular patch of ultramarine is nearly gone. The scapulars are as in *motleyi*, but some of the upper median wing coverts are rufous and the greater wing coverts and outer margins of the secondaries are irregularly tipped with rufous.

(3). M.C.Z. 197134, ♂, ad. Sandakan, Borneo, June 18, 1937. H. G. Deignan. Above this specimen is uniformly rufous with a lilac wash. There is no trace of either forehead or supraocular spot. The scapulars present a curious violet tone from the mingling of ultramarine and lilac washes. The lesser median wing coverts are rufous. The greater wing coverts are black with a bluish-lilac subterminal wash and rufous edgings. This bird stands almost exactly in an intermediate position between *motleyi* and *rufidorsus*.

(4). M.C.Z. 69608, ad. Linibang, Sarawak, Borneo, no date. Above this bird has a forehead spot and supraocular spot. The scapulars are, however, predominately rufous-lilac. The lesser and median wing coverts are rufous, the greater strongly tipped with ultramarine.

(5). M.C.Z. 69610, ad. Borneo, 1915. H. W. Smith. Above this bird is similar to *rufidorsus*. However, it is an adult specimen and so should not have curious patchy blackish and ultramarine tinted scapulars. The wing coverts are similar to *rufidorsus* ex-

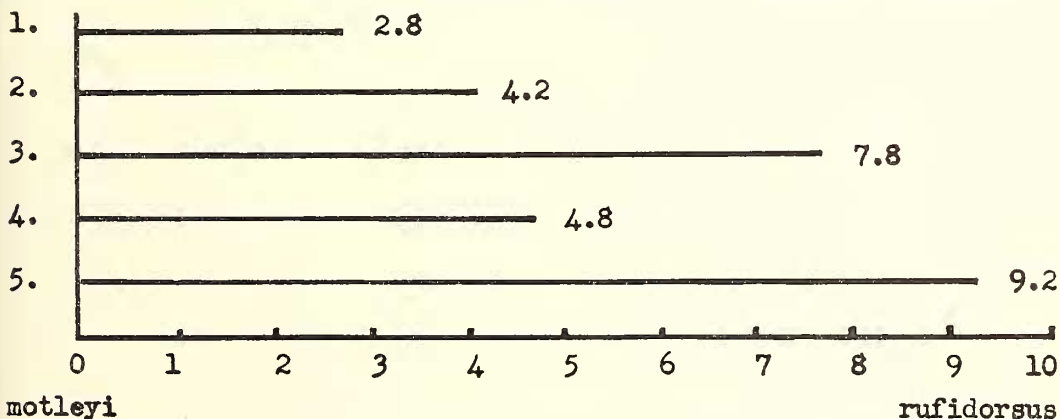
cept that there is a hint of ultramarine on the tips of some of the greater one.

(6). M.C.Z. 69609, o im., Kuala Treban, Sarawak, Borneo, Feb. 28, 1918. An immature hybrid is of interest. Above this specimen shows a prominent forehead spot and the merest trace (two feather tips) of a supraocular patch. The scapulars are black with a few faint tips of ultramarine. The lesser and median wing coverts are largely rufous, the greater are black, washed with ultramarine and with faint rufous edgings. Below this bird is typically immature, having a white throat and strongly rufous cheeks, flanks, and breast band.

The above specimens represent almost a complete transition from *erithacus motleyi* to *rufidorsus rufidorsus*. Each bird represents a greater or less blending of the distinctive characters of the two species. Here indeed is an interesting example of two closely related forms of kingfisher which do not quite satisfy any of the concepts of taxonomy or speciation. On the one hand the color of the back is so different that many taxonomists would consider these birds to belong to two species. Others might lump them, if it were not for the overlapping of their ranges. From the speciation point of view they do not conform either to a Super-species or to a *rassenkreis*. And yet the birds would satisfy any geneticist as to their close ancestry by their apparent readiness to hybridize.

Shown on a linear scale, the characters of these hybrids indicate quite clearly their intermediate position. Letting certain characters equal certain numbers we arrive at an arbitrary scale as follows:

	<i>erithacus motleyi</i>	<i>rufidorsus rufidorsus</i>
Forehead spot	present—0	absent—10
Supraocular spot	present—0	absent—10
Scapulars	blue—0	rufous lilac—10
Lesser & median wingcoverts	black—0	rufous—10
Greater wing coverts	black—0	rufous—10



Text-fig. 1. The numbers on the left are those of the individual specimens. The base line represents the scale from *motleyi* to *rufidorsus*. At the end of each specimen's line is the figure representing the sum of its characters.

By adding up each specimen's score and dividing by five we arrive at the following:

The original description of *Ceyx dillwyni* Sharpe (1868) would have sufficed for the local race of *erithacus*, if it had not been for the fact that not only did Sharpe not mention a supraocular patch as occurring on his type, but Salvadori (1869) specifically says that it did not have one. I cannot find a single undoubted specimen of the species *erithacus* which does not possess this spot. Any specimen, therefore, coming from Borneo or Sumatra or the Malay Peninsula (as will be seen later) which is an adult but does not possess either the forehead spot or supraocular patch, and yet which has ultramarine on scapulars or wing coverts must be considered to be potentially a hybrid.

Ceyx erithacus captus Ripley.

Ceyx erithacus captus Ripley, *Proc. New Eng. Zool. Club*, XIX, 15, Dec. 29, 1941.

Description: This race differs from *motleyi* by its longer bill and slightly larger size, and by reduction of the forehead spot which is lacking in one specimen. This last character was not mentioned in the original description due to the fact that the question of the hybrid population of *motleyi* has not been elucidated.

From *erithacus* this race differs as *motleyi*.

I have seen no immature specimens.

Measurements: Wing, ♂ 59.5–62.5 (60.8). Tail, ♂ 23–24 (25.6). Wing-tail index 39–40. Bill 32–33.5 (32.6).

Range: Nias I. West Sumatra.

Specimens Examined: Three.

Discussion: It is interesting to note that *captus*, as *macrocarus*, differs from its nearest relative by size. In this case it is the bill which is notably larger. Like *macrocarus*, also, the forehead spot and the supraocular patch are much reduced.

Ceyx erithacus vargasi Manuel.

Ceyx erithacus vargasi Manuel, *Phil. Journ. Science*, 69, No. 4, 383, Aug., 1939.

Description: Differs from *motleyi*, which it otherwise closely resembles, by the reduction of the lilac wash on the upper surface. In the specimen examined this wash occurs only in a supraorbital stripe ending in an ultramarine supraocular patch, and on the lower back, two areas where the color is most highly concentrated in *motleyi*. The ultramarine wash on the scapulars also is reduced to the tips of one or two feathers. The specimen examined, though otherwise in adult plumage, has a black shaft and a black stripe along the middle of the terminal half of the tail feathers.

Measurements (one female): Wing 56.5. Tail 24. Wing-tail index 42. Bill 28.5.

Range: Mindoro I., Philippine Islands.

Discussion: The existence of this population of *Ceyx erithacus* was only discovered in 1939 by Manuel who noticed that two specimens of *Ceyx* had the blue supraocular patch not found in *rufidorsus*. It is worth noting that *Ceyx melanurus* behaves in a strictly representative way in the Philippines with *rufidorsus*, while *erithacus* has incurred on the range of *rufidorsus* on Mindoro.

Ceyx rufidorsus rufidorsus Strickland.

Ceyx rufidorsus Strickland, *Proc. Zool. Soc.*, p. 99, 1846.

Ceyx innominatus Salvadori, *Atti R. Accad. Sci. Torinno*, IV, p. 465, 1869.

Description: Above, rufous washed with lilac, scapulars and wing coverts as the back, primaries black, the first edged with rufous, secondaries black edged with rufous. Ordinarily this species lacks a dark forehead spot (three times present in 25 examples) and an ultramarine supraocular patch (twice present in 25 examples). Below the throat is white, the rest of the underparts being rich yellow.

Immature birds differ from the adult by having less of the bright lilac wash on the rufous upper parts. A nestling (A.M.N.H. 637014) from Gunong Tahan, Pahang, Malay Penin., collected in November, has black scapulars tinted with rufous and with one or two faint spots of ultramarine. The wing coverts tend to have rather more black than the adult. The tail is entirely rufous. Below the throat and belly are white, the cheeks, flanks, and a band across the abdomen rufous.

An immature male from East Java (A.M.N.H. 637034) collected in August, has completely rufous scapulars. This bird is one of the specimens which has an ultramarine spot above the ear. Below it agrees with the other specimens.

An immature female from Borneo (A.M.N.H. 637055) collected in September, has blackish scapulars overlaid with rufous and a black-tipped tail.

Measurements (adults): Wing, ♂ 56.5–60.5 (58.2), ♀ 59.5–60.5 (60). Tail, ♂ 22.7–25 (23.7), ♀ 24–24.7 (24.2). Wing-tail index 39–41. Bill, from naris, ♂ and ♀, 27–32 (28).

Range: Malay Peninsula, Rhio and Lingga Islands, Banka, Billiton, Sumatra, Siberut, Sipora, Java, Bali, Lombok, Sumbawa, Flores, Kangean, Bawean, Borneo, North Natuna, Anamba Ids, and Philippines, Palawan, Balabac, Mindoro, Tawitawi, Bongao, Calamianes.

Specimens Examined: Twenty-one.

Discussion: Several specimens from the Malay Peninsula and Sumatra have been noted which appear to be hybrids.

(1). An adult female (A.M.N.H. 637027) from the Deli district of Sumatra, Van Heyst coll., has a prominent forehead spot

and an infusion of ultramarine in the supra-ocular area. The scapulars, lesser and median wing coverts are mixed with black and ultramarine.

(2). Another adult female (M.C.Z. 17707) from Benkoolen, Sumatra, has a prominent forehead spot and blackish scapulars and wing coverts irregularly spotted with traces of ultramarine.

(3). A juvenal male (U.S.N.M. 180199) from Kateman River, E. Sumatra, collected in August, has the forehead spot and black tipped with ultramarine scapulars of *erithacus*, but it lacks the supraocular patch. The terminal half of the tail along the shaft of the feathers is black.

(4). An immature specimen from Great Karimon Id., E. Sumatra, (U.S.N.M. 180198) collected in May, has a black forehead patch and mixed scapulars, black and rufous, with lilac and ultramarine spots.

(5). A male molting into adult plumage (A.M.N.H. 637012) from western Pahang, Malay Peninsula, collected in January, has the blue forehead spot and supraocular patch of *erithacus*. However, the wing coverts, as in some of the Bornean hybrids, are mainly rufous.

These specimens indicate clearly that wherever the range of these two species overlap, there is a pronounced tendency to hybridization. From them it is clear that any specimen from Sumatra, the Malay Peninsula or Borneo, which seems to be adult but has either of the following combinations, must be suspect.

Hybrid Type A: Forehead spot and supraocular patch present, but scapulars and wing coverts largely rufous.

Hybrid Type B: Forehead spot and supraocular patch absent, but scapulars and wing coverts largely black with an ultramarine wash.

Specimens from Java tend to be slightly smaller, but tests for the significance of these data by the formula of *T*, show that the differences are not valid and the name *inuominatus* cannot be upheld.

Ceyx rufidorsus jungei ssp. nov.

Type: M.C.Z. no. 178157, ♂ ad., collected by E. Jacobson and W. C. vanHeurn, July 28, 1913, Ajer Dingin, Simalur I.

Diagnosis: From *C. r. rufidorsus* this race differs by its larger size.

Measurements (of type): Wing 62, tail 26, bill 31.5; (of series): Wing, ♂ 62–64.5 (63.2), ♀ 62.5–63.5 (63). Tail, ♀ 25–26 (25.5), ♂ 25.5–26.5 (26). Wing-tail index 39–42. Bill, ♂ and ♀, 30.5–32 (31.3).

Range: Simalur and Batoe Ids, Tanah Massa and Tanah Bala.

Specimens Examined: Seven.

Discussion: This race is decidedly larger than *rufidorsus* from the rest of the range. It is interesting to note that the bill measurements, though averaging larger, are not

significantly so when the probability is computed by standard deviation. Birds from Siberut and Sipora, as listed by Chasen & Kloss (1926), agree in size with typical *rufidorsus*. Here again, as in the two races of *Ceyx erithacus* on small islands north and west of Sumatra, this population of kingfishers differs from its nearest relatives by larger size. This race is named in honor of Dr. G. C. A. Junge of the Leiden Museum who has always been interested in East Indian birds.

CONCLUSION.

Ceyx erithacus and *rufidorsus* are closely allied species and might be considered conspecific were it not for the fact that their ranges are overlapping. In the Malay Peninsula, Sumatra and Borneo where this occurs, specimens were examined which show hybrid characters indicating that the earlier confusion in the nomenclature was probably due to this phenomenon. *Ceyx rufidorsus* is considered to be the older species due to its more extensive range.

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